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Diffusion and rheology in a suspension of hydrodynamically interacting colloids enclosed by a spherical cavity[1] CHRISTIAN APONTE-RIVERA, ROSEANNA ZIA, Cornell University — We study diffusion and rheology of a suspension of hydrodynamically interacting colloidal spheres enclosed by a spherical cavity, utilizing the Stokesian Dynamics framework to account for long-range many-body and pairwise lubrication interactions between the particles and between particle and enclosure. Previous studies of 1D- and 2D-confined suspensions have revealed that boundaries exert a pronounced qualitative influence on microstructure, dynamics, and rheology. While studies of the motion of a point particle in a cavity have been reported, the neglect of finite size sacrifices significant qualitative information, resulting in an incorrect coupling between torque and velocity, among others. We have derived new hydrodynamic mobility functions for finite-size particles confined by a spherical boundary that faithfully capture the physics of the boundary and its influence on particle dynamics. We obtain the full grand-mobility matrix and, from these, the position-dependent short-time self-diffusivity for an isolated particle and the dynamics of a hydrodynamically interacting pair suspended in the cavity. Both of these are studied over a range of particle-to-cavity size ratios.

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